SEDIMENT QUALITY IN PUGET SOUND: 1997 - 2003 BASELINE CONDITIONS

Aasen S, Dutch ME, Long ER, Welch KI
Washington State Department of Ecology, Olympia, WA

I. Findings

- ~65% of Puget Sound has high quality sediments.
- ~35% of Puget Sound has intermediate quality sediments.
- <1% of Puget Sound has degraded sediments.
- Degraded sediments were most prevalent in the Whidbey Basin and Central Sound regions (Everett Harbor, Elliott Bay, Commencement Bay).
- A higher degree of degradation in critical nearshore habitat may disproportionately affect important fish, shellfish, and aquatic plant species.
- A baseline for Puget Sound sediment quality has been established.

II. Study Design

Sediment quality in Puget Sound is monitored by the Department of Ecology annually as a component of the Puget Sound Assessment Monitoring Program (PSAMP). A primary objective of this program is to quantify the spatial extent and geographic patterns of degraded sediment quality throughout Puget Sound. Sediments are collected at stations, selected with a stratified random sampling method. Using the Sediment Quality Triad approach, samples were analyzed for potentially toxic chemicals, acute toxicity in laboratory tests, and invertebrate communities residing in the sediments. Results of these analyses are used to identify spatial patterns and spatial extent of the degraded sediment quality in Puget Sound

III. What Is The Sediment Quality Triad Index?

The Sediment Quality Triad Index was developed as a weight-of-evidence approach that combines the results of sediment chemistry, toxicity, and benthic invertebrate analyses generated in this study to classify the overall quality of the sediment samples. The following four categories of sediment quality were generated to define each station and, ultimately, each sediment monitoring region and stratum of the study:

- **High Quality** – no degradation detected in any of three test parameters
- **Intermediate/High Quality** – degradation detected in one of three test parameters
- **Intermediate/Degraded Quality** – degradation detected in two of three test parameters
- **Degraded Quality** – degradation detected in all three test parameters

IV. Evaluation of Sediment Quality in Monitoring Regions

The spatial extent of sediment quality in eight Puget Sound study regions was calculated as both percent of stations in each category and percent of area affected within each region (Figure 1). Sediment monitoring regions are defined by their unique hydrologic, bathymetric, and geological features, as well as by the distribution of biota (fish, birds, and marine mammals) within each region.

The regions differed dramatically in their degree of sediment quality. Most samples classified as degraded were collected in the Whidbey Basin and Central Sound regions.

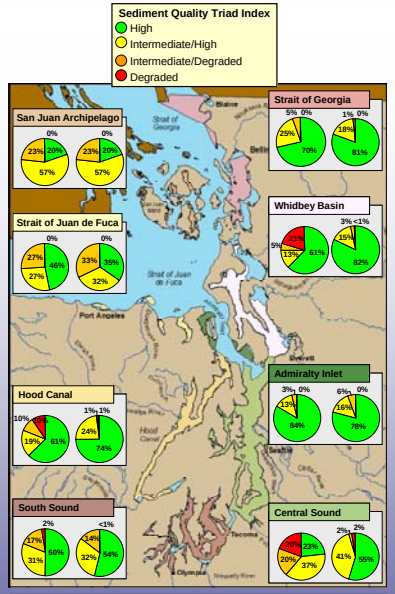

Figure 1. Sediment Quality Triad Index in eight Puget Sound monitoring regions. Percent of stations (left pie chart) and percent of area (right pie chart) representing each index category are depicted for each region.

V. Evaluation of Sediment Quality in Monitoring Strata

The spatial extent of sediment quality also was calculated for five areas delineated as sediment monitoring strata: harbor, urban, passage, basin, and rural (Figure 2). These strata characterize Puget Sound sediments in areas defined by their major geographic features and degree of anthropogenic activity.

Sediment quality differed dramatically among the strata. The largest percentage of samples (47%) with degraded sediment quality was found in the harbor stratum. Intermediate sediment quality also was most pervasive in the harbors, followed by the urban embayments. Highest sediment quality was prevalent in the passages, deep basins, and rural embayments.

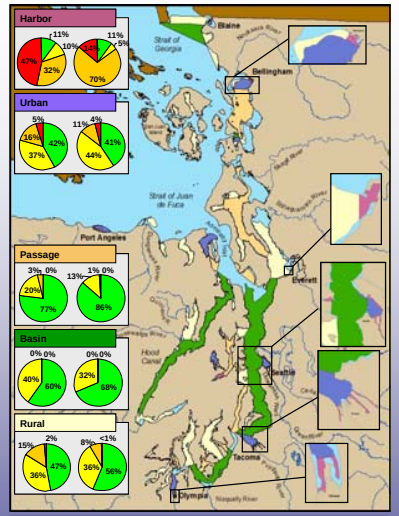

Figure 2. Sediment Quality Triad Index in five Puget Sound monitoring strata. Percent of stations (left pie chart) and percent of area (right pie chart) representing each index category are depicted for each stratum.

Photographs by Charles Eaton

VI. Evaluation of Sediment Quality in the Entire Study Area

The Sediment Quality Triad Index indicated that sediments from approximately 19 km^2, or 0.8% of the Puget Sound study area, were degraded, with impairment apparent in all three indicators (Table 1). Sediments with intermediate quality, or a mixture of impaired sediment quality indicators, were distributed over 826 km^2, or about 34.6% of the area. High quality sediments, as indicated by low chemical concentrations, absence of toxicity, and presence of abundant and diverse infaunal communities, were found in 1543 km^2, representing 64.6% of the study area.

Table 1. Sediment Quality Triad Index in the entire Puget Sound study area.

Sediment Quality Index Category	Stations		Area	
	No.	Percent	km^2	Percent
Total Study area	381	100.0	2388.6	100.0
High	176	46.2	1543.0	64.6
Intermediate/High	114	29.9	692.0	29.0
Intermediate/Degraded	55	14.4	134.4	5.6
Degraded	36	9.4	19.2	0.8

General information and all data generated during this survey can be accessed from Ecology's Marine Sediment Monitoring website:

http://www.ecy.wa.gov/programs/eap/mar_sed/msm_intr.htm